

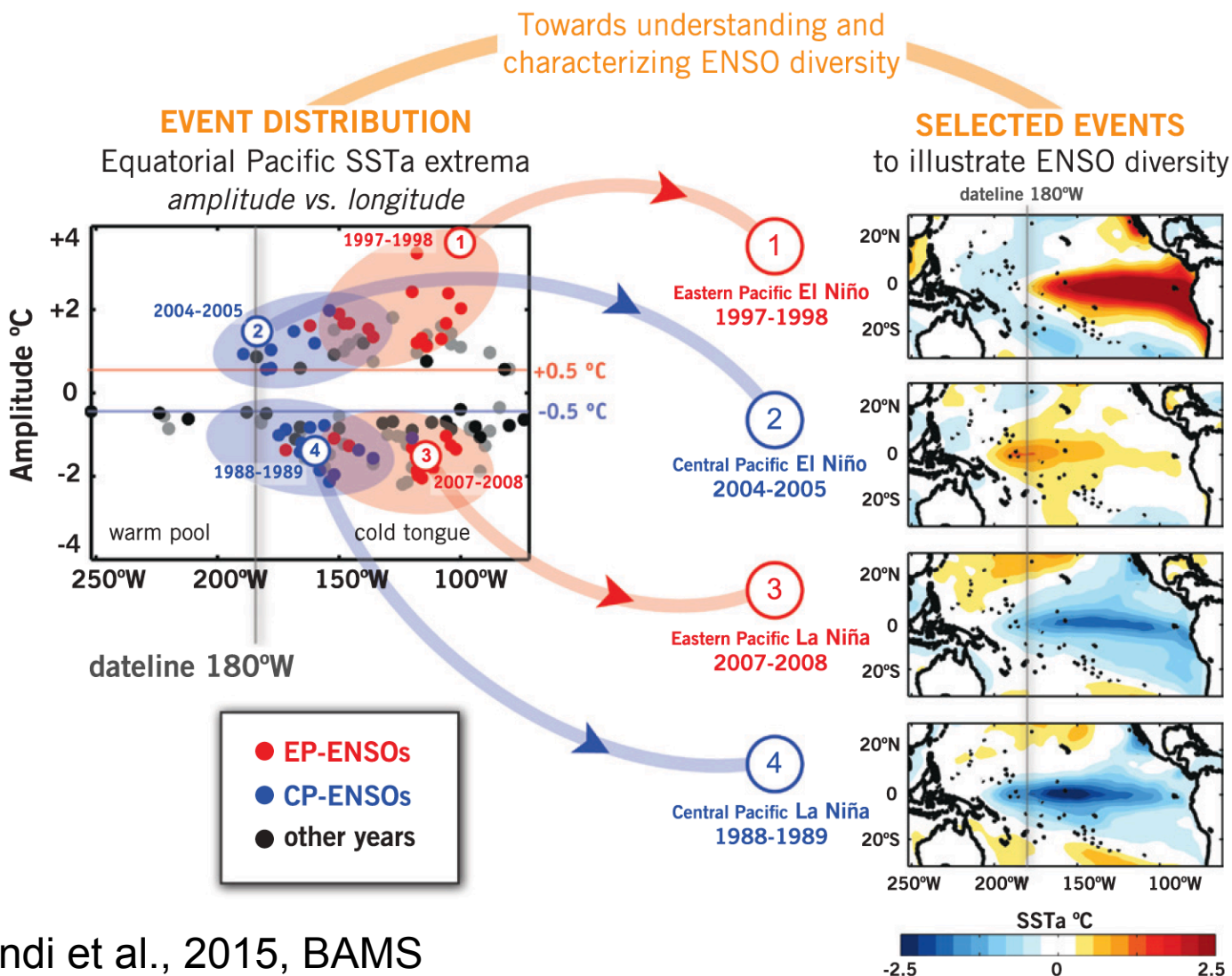


Analysis of the Radiative Effects of the Recent El Nino Using CERES FLASHFlux and EBAF Datasets

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El Niño Diversity

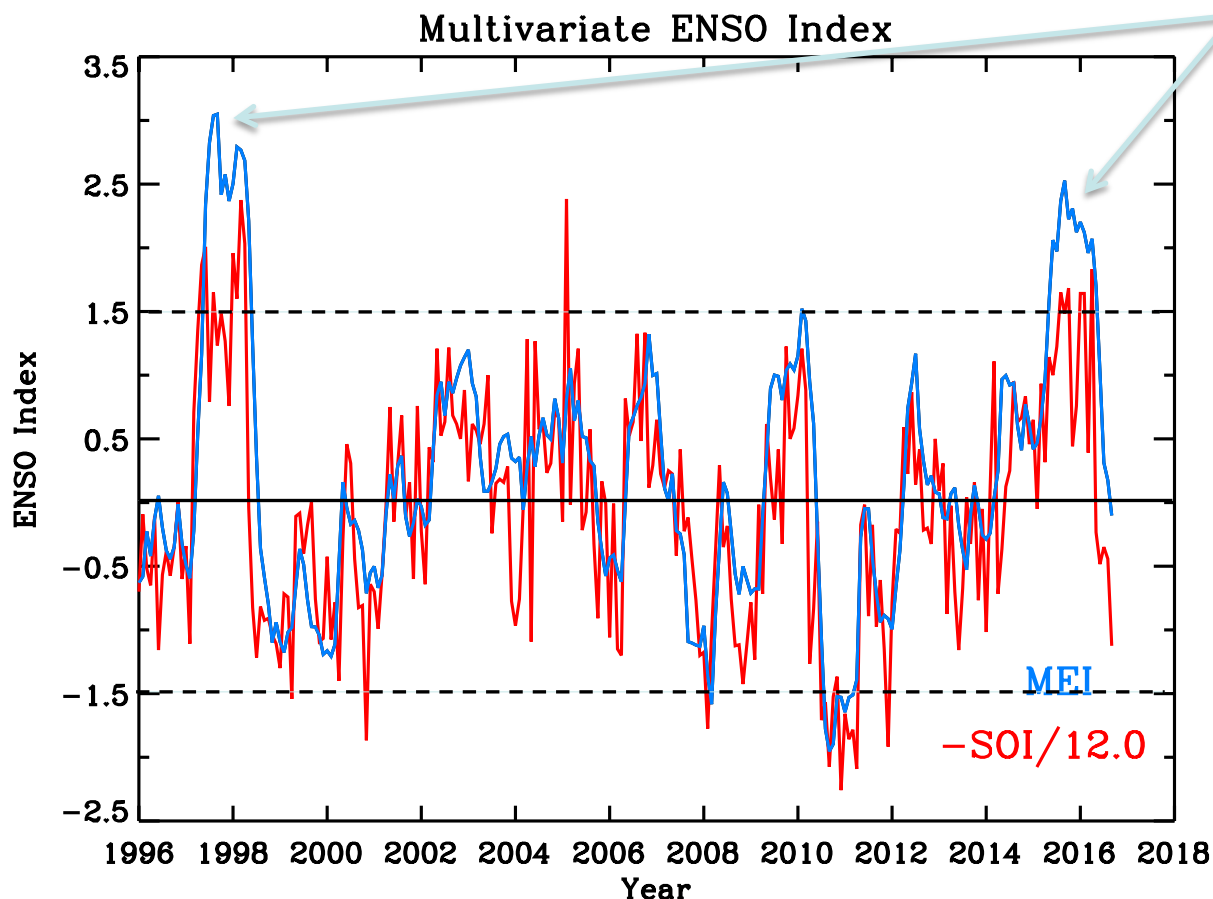


Capatondi et al., 2015, BAMS



MEI/SOI El Niño Indexes

The 2015-2016 El Niño rivaled some of the large El Niño's of the past



Comparing the MEI to the SOI, we see that the 1997/98 El Niño event and 2015/16 El Niño event may show some similarity.

- CERES EBAF Ed 2.8 & FLASHFlux 3B to analyze the 2015/16 El Niño event.
- Use GEWEX SRB to analyze the 1997/98 El Niño event.



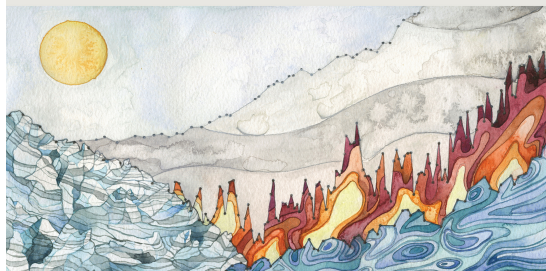
Data Sets

- *CERES EBAF – TOA (Ed 2.8): Monthly and climatological averages TOA all-sky fluxes, where TOA net flux is constrained to the ocean heat storage.*
- *CERES FLASHFlux – TISA (Ed 3b): Daily TOA fluxes, MODIS based clouds, and parameterized surface fluxes within one week of satellite retrieval. Not of climate quality.*
- *NASA/GEWEX Surface Radiation Budget (SRB) Release 3.0/3.1: TOA fluxes, ISCPP based clouds, and surface fluxes from January 1983 through December 2007.*



Earth's Radiation at TOA

STATE OF THE CLIMATE IN 2015



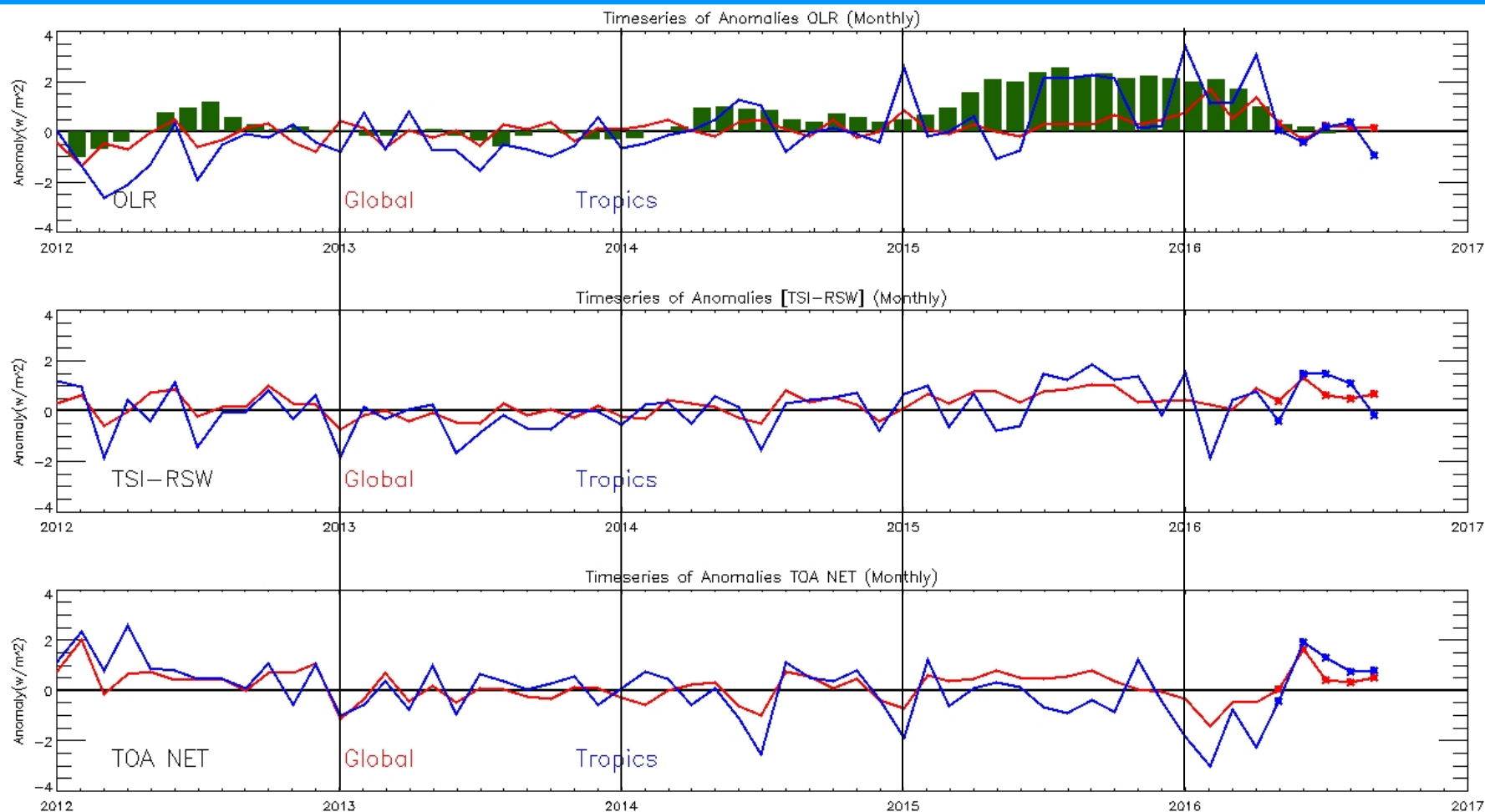
Global monthly mean deseasonalized anomalies produced by merging datasets from CERES EBAF TOA Ed2.8 and CERES FLASHFlux product. The FLASHFlux data have been normalized to the EBAF data using TOA fluxes from both datasets for the six-year period from January 2009 through December 2014.

	Global-annual Mean Difference (2015 minus 2013) (W m^{-2})	Global-annual Mean Difference (2015 minus 2014) (W m^{-2})	2015 Anomaly (relative to climatology) (W m^{-2})	Interannual variability (2001 to 2014) (W m^{-2})
OLR	+0.30	+0.15	+0.30	± 0.50
TSI	+0.05	+0.05	+0.10	± 0.20
RSW	-0.75	-0.45	-0.55	± 0.40
Net	+0.50	+0.40	+0.35	± 0.65

The 2015 Reflected Shortwave anomaly is 0.15 Wm^{-2} larger than 2-sigma Interannual variability (2001 to 2014).



Global and Tropical Deseasonalized Anomalies



Global and Tropical(20N-20S) deseasonalized monthly anomalies extend to June 2016. The global anomalies correlate well with the tropical anomalies.



2015 El Niño: 2015 - 2013

global = 1.34022

60-90N = 1.32168

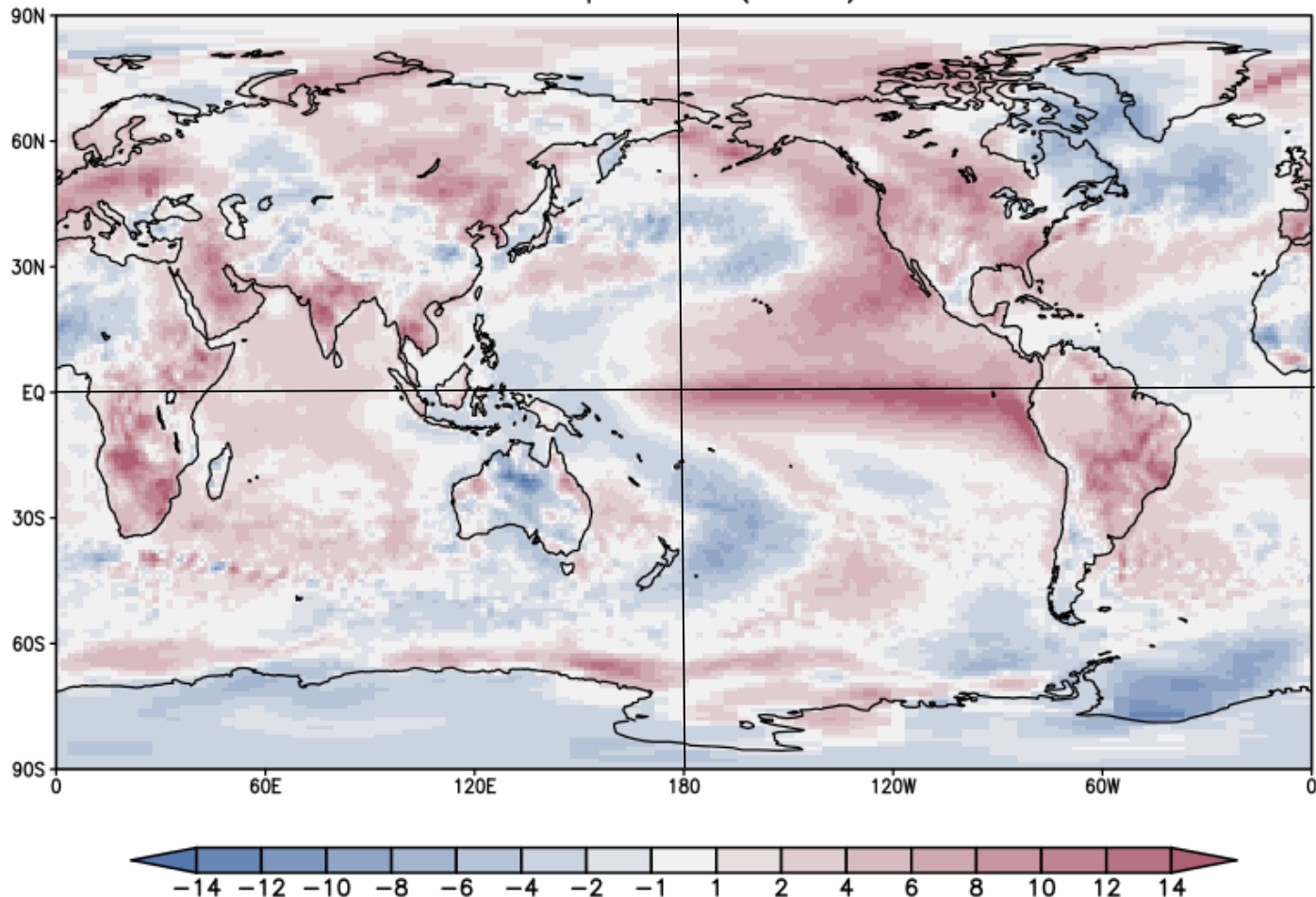
60-90S = -1.25604

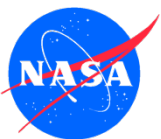
20N-20S = 2.27353

20-60N = 1.87749

20-60S = 0.253149

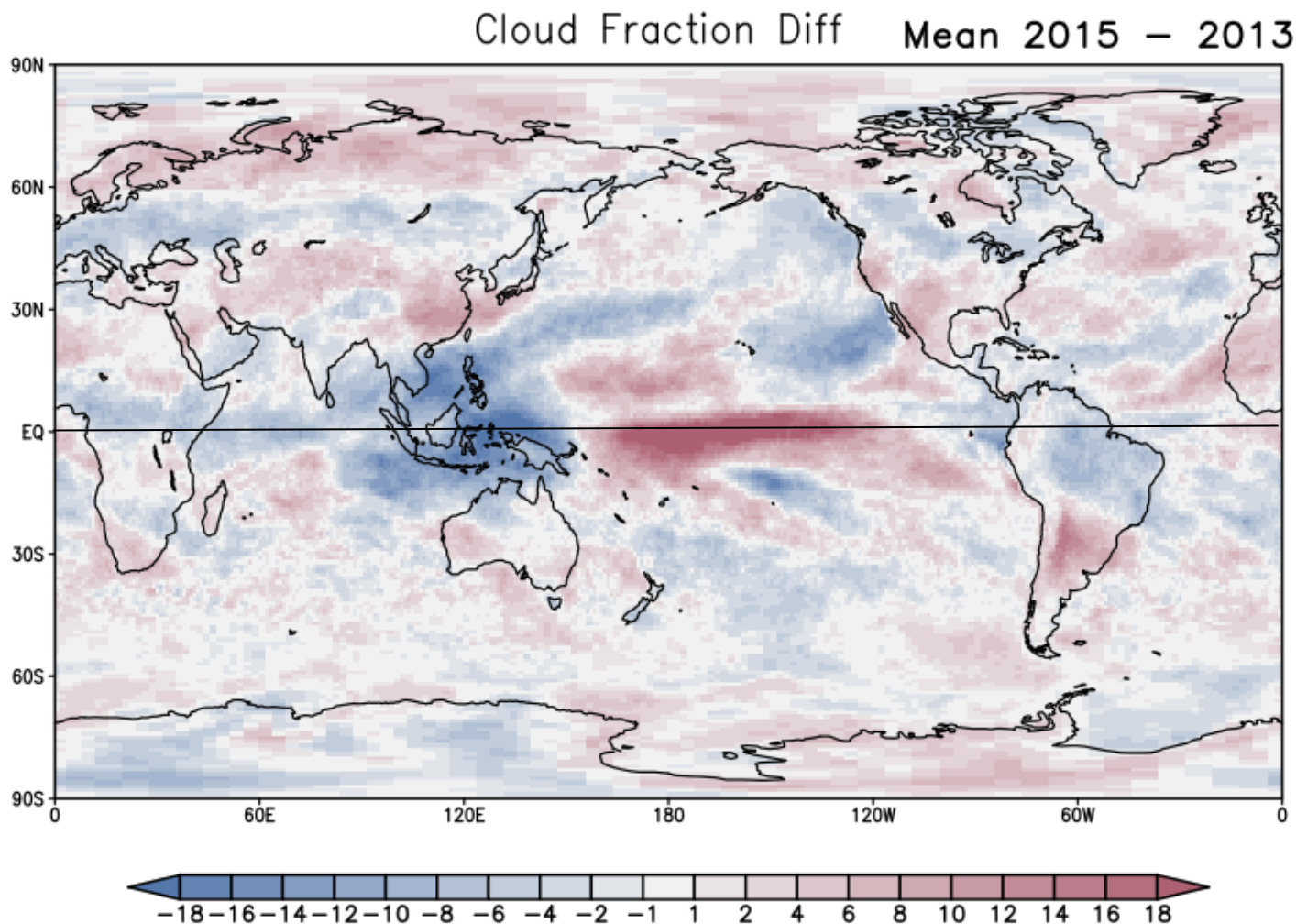
LW Up Surf (Wm^{-2}) Diff Mean 2015-2013



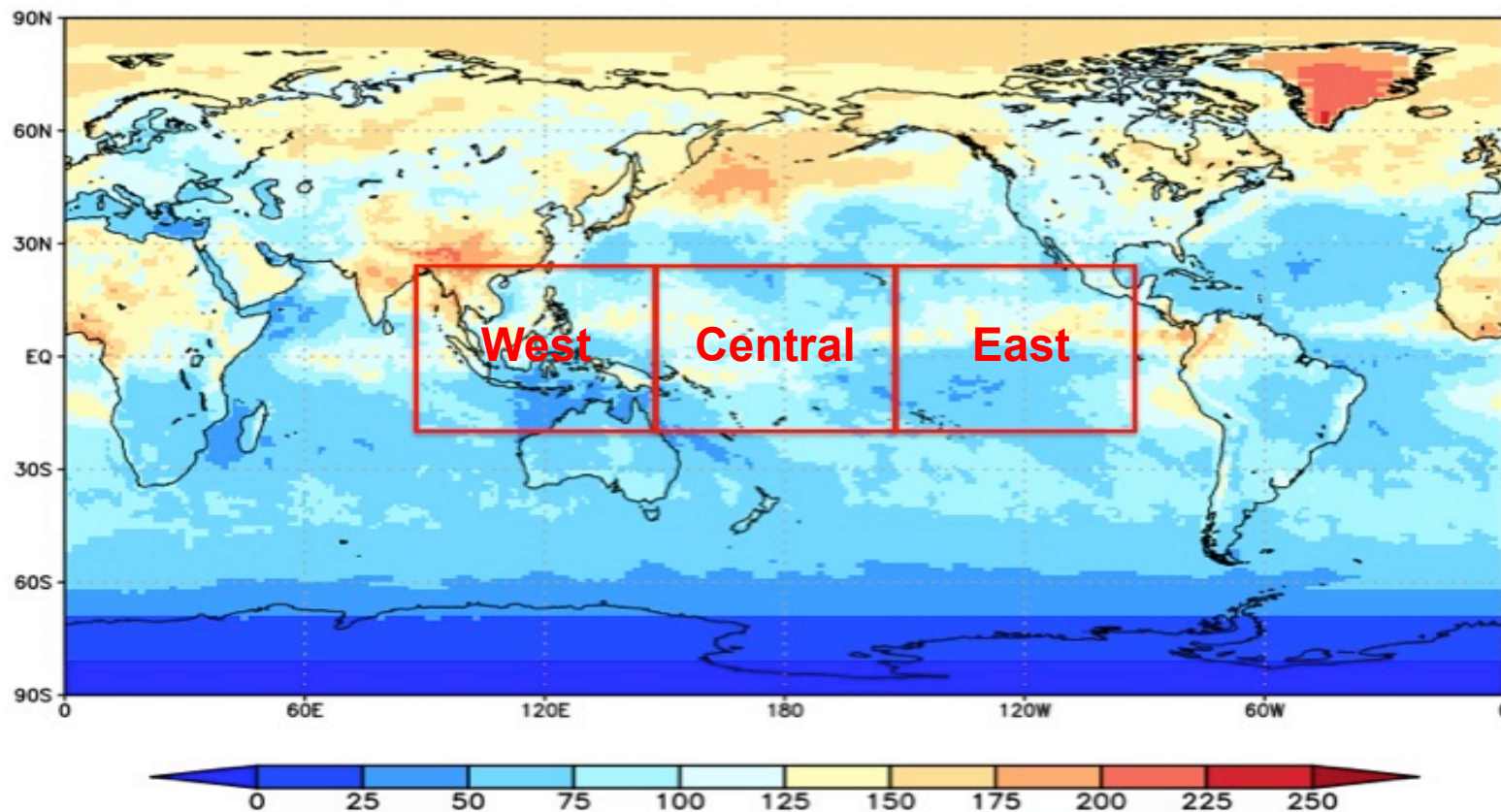


2015 El Niño: 2015 - 2013

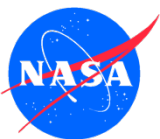
global = -0.135397 60-90N = 2.06199 60-90S = 0.104356 20N-20S = -0.826933
20-60N = -0.248374 20-60S = 0.257364



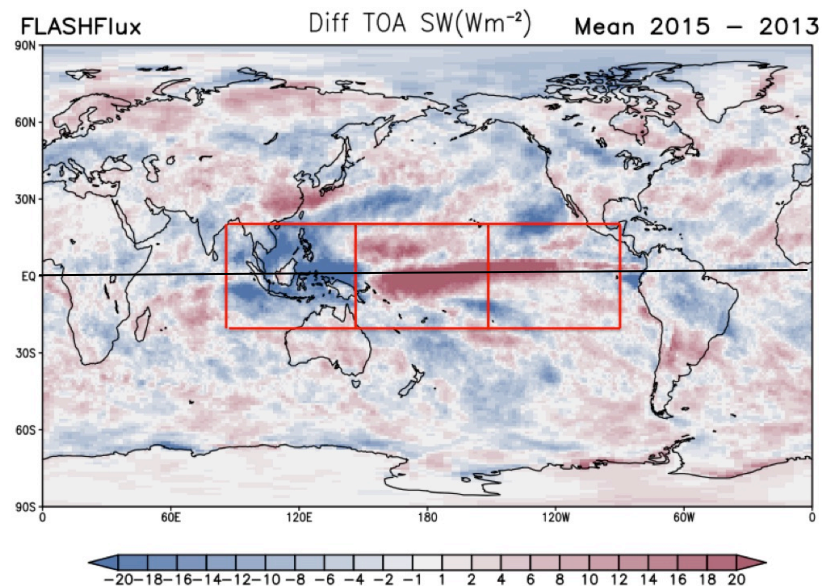
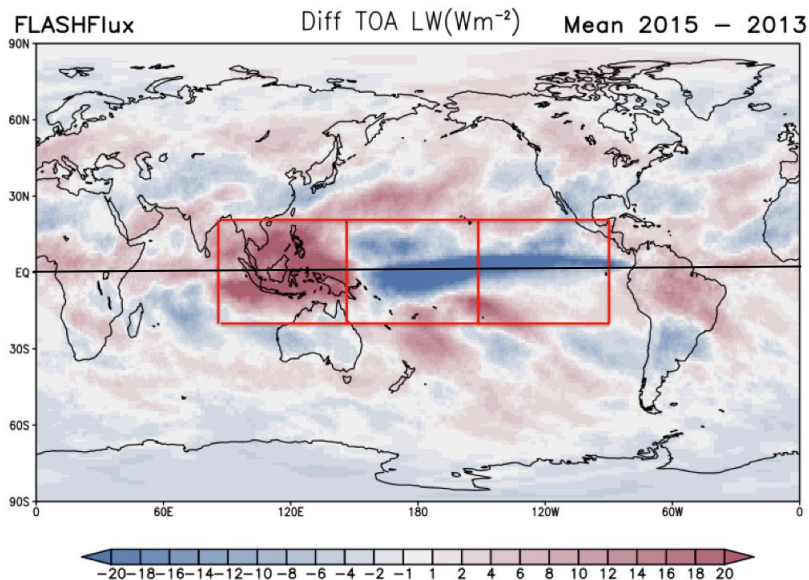
Tropical Pacific Analysis



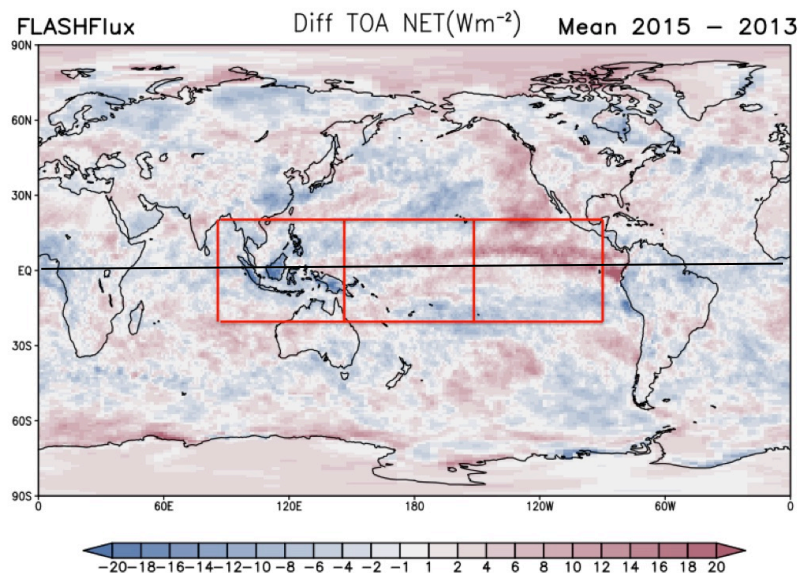
- Tropical West Pacific: 20N-20S, 90E-150E
- Tropical Central Pacific: 20N-20S, 150E-150W
- Tropical East Pacific: 20N-20S, 150W-90W



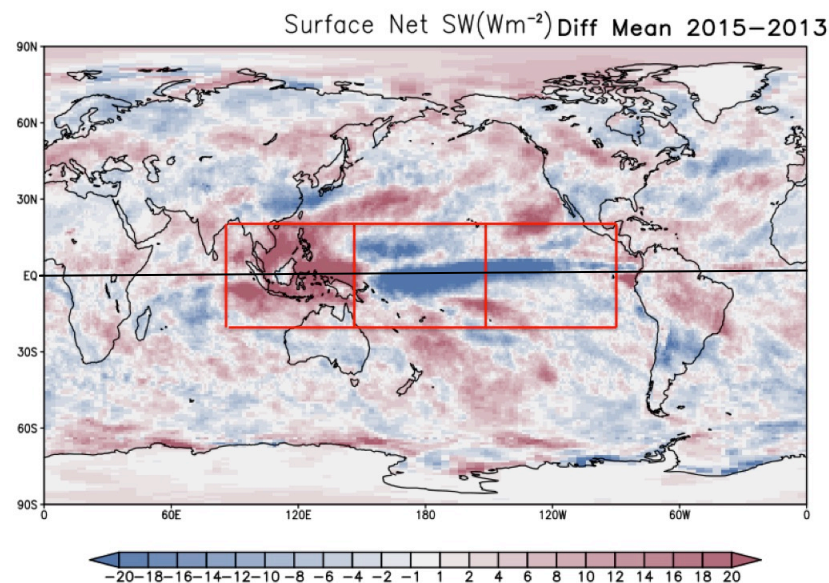
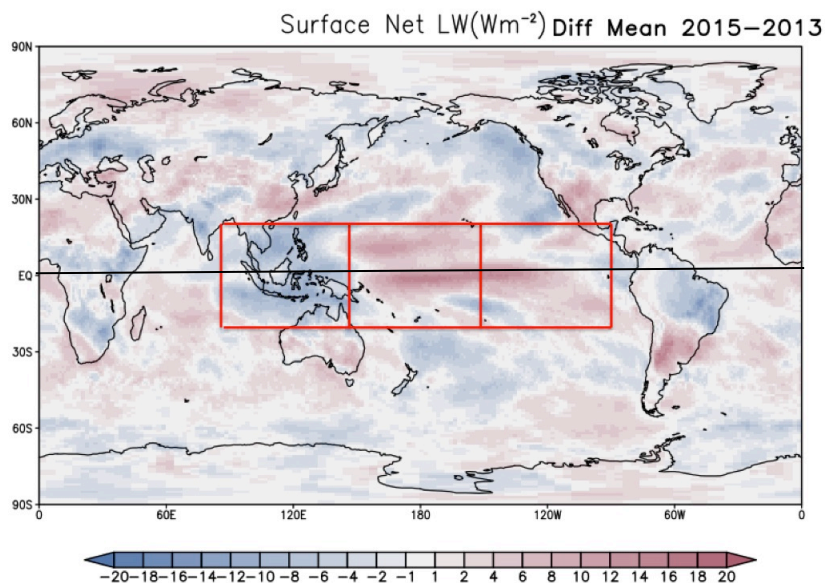
2015 El Niño: TOA 2015 - 2013



Near total SW/LW
cancellation over W. Pacific,
but strong positive net
difference in E. Pacific and
up W. coast of US.

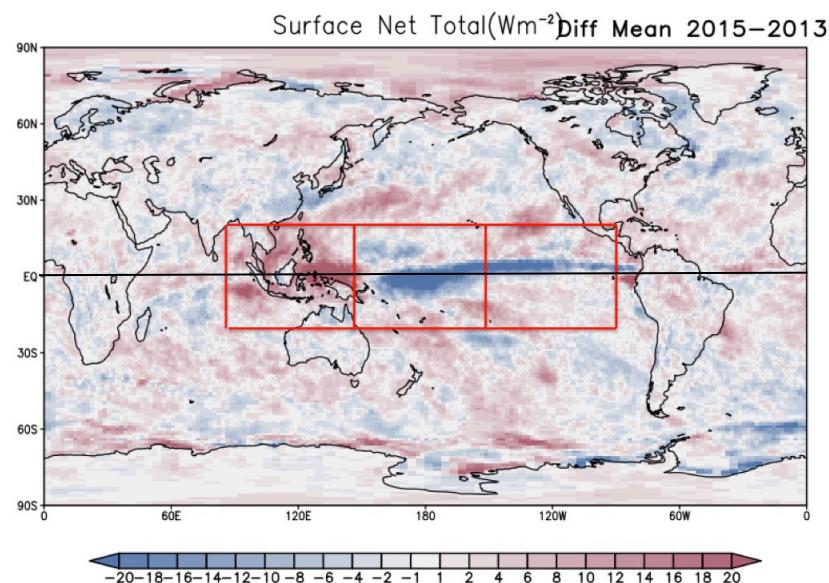


2015 El Niño: Surface 2015 - 2013

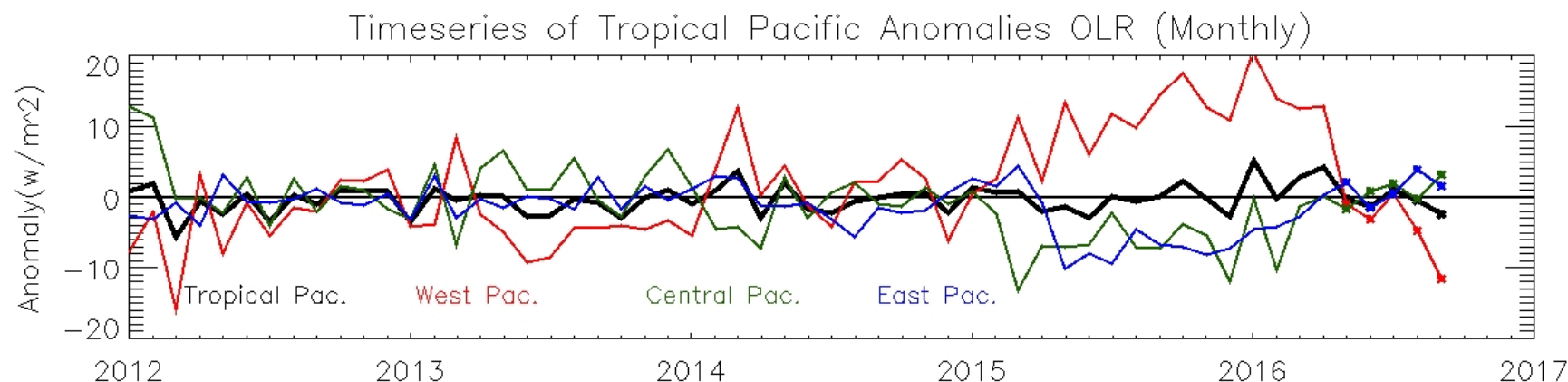
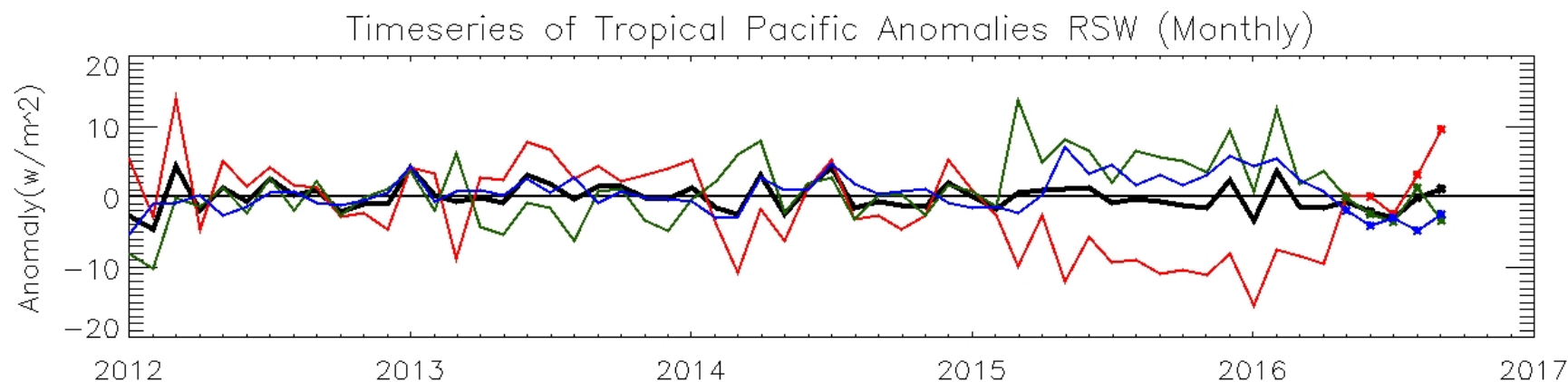


At surface, net LW < 0 ; so
reduction makes more negative;
increase means less negative

At surface, some partial SW/
LW cancellation in each
region, but SW change
appears to dominate



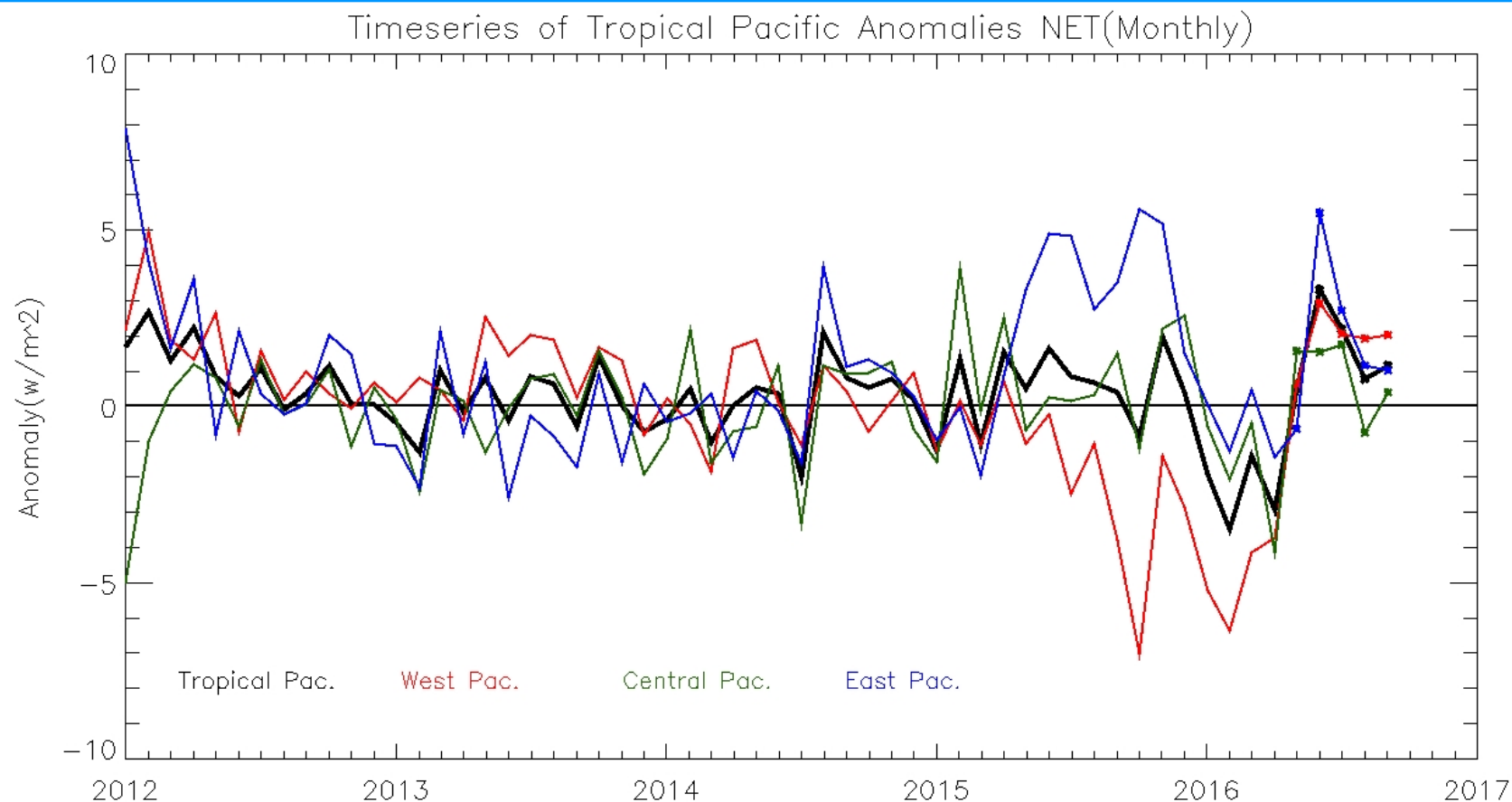
Monthly Flux TOA Anomalies[CERES EBAF&FF]



- The **West** Pacific region shows a decrease in RSW, while the **Central** and **East** Pacific show an increase in RSW.
- The OLR anomalies show similar pattern to RSW, but in the opposite direction.



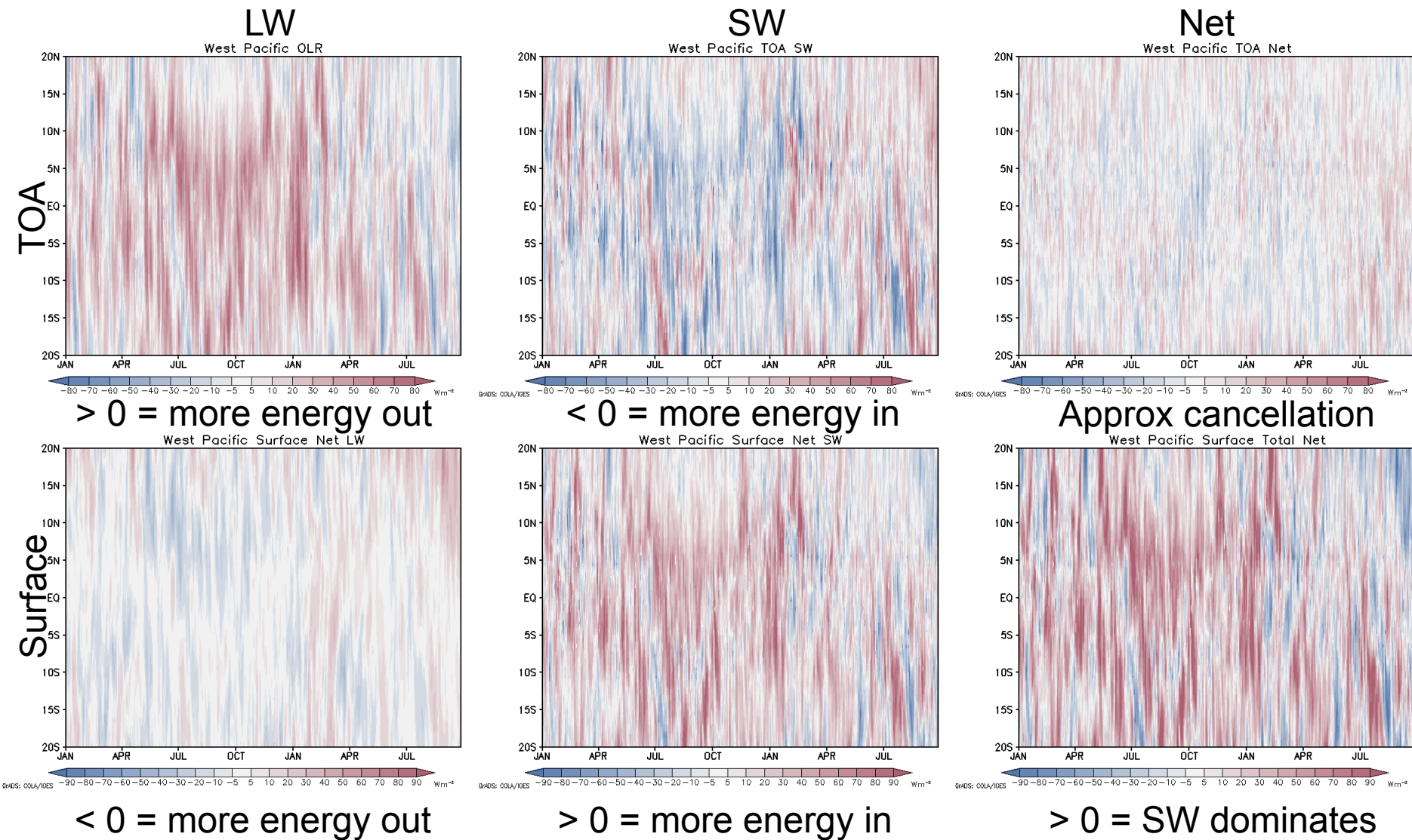
Monthly Flux TOA Anomalies[CERES EBAF&FF]



- The **West** Pacific region shows a decrease in Net, while the **Central** and **East** Pacific show an increase in 2015 but become negative net in 2016.
- The tropical Pacific region as a whole shows a relative balance between the **West** and **Central/East** regions.

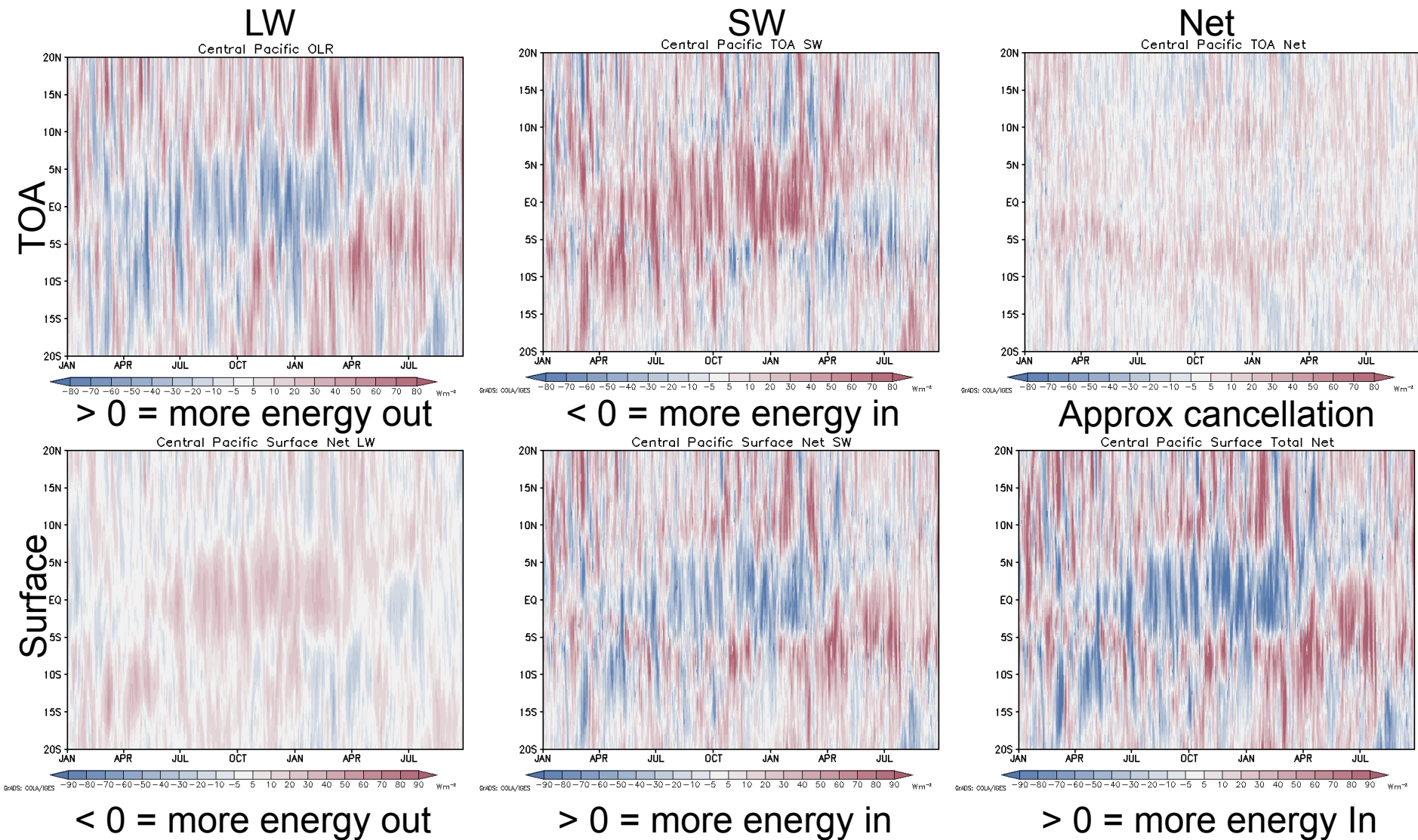


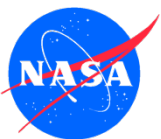
Western Pacific Daily 2015/16 Minus 2013/14



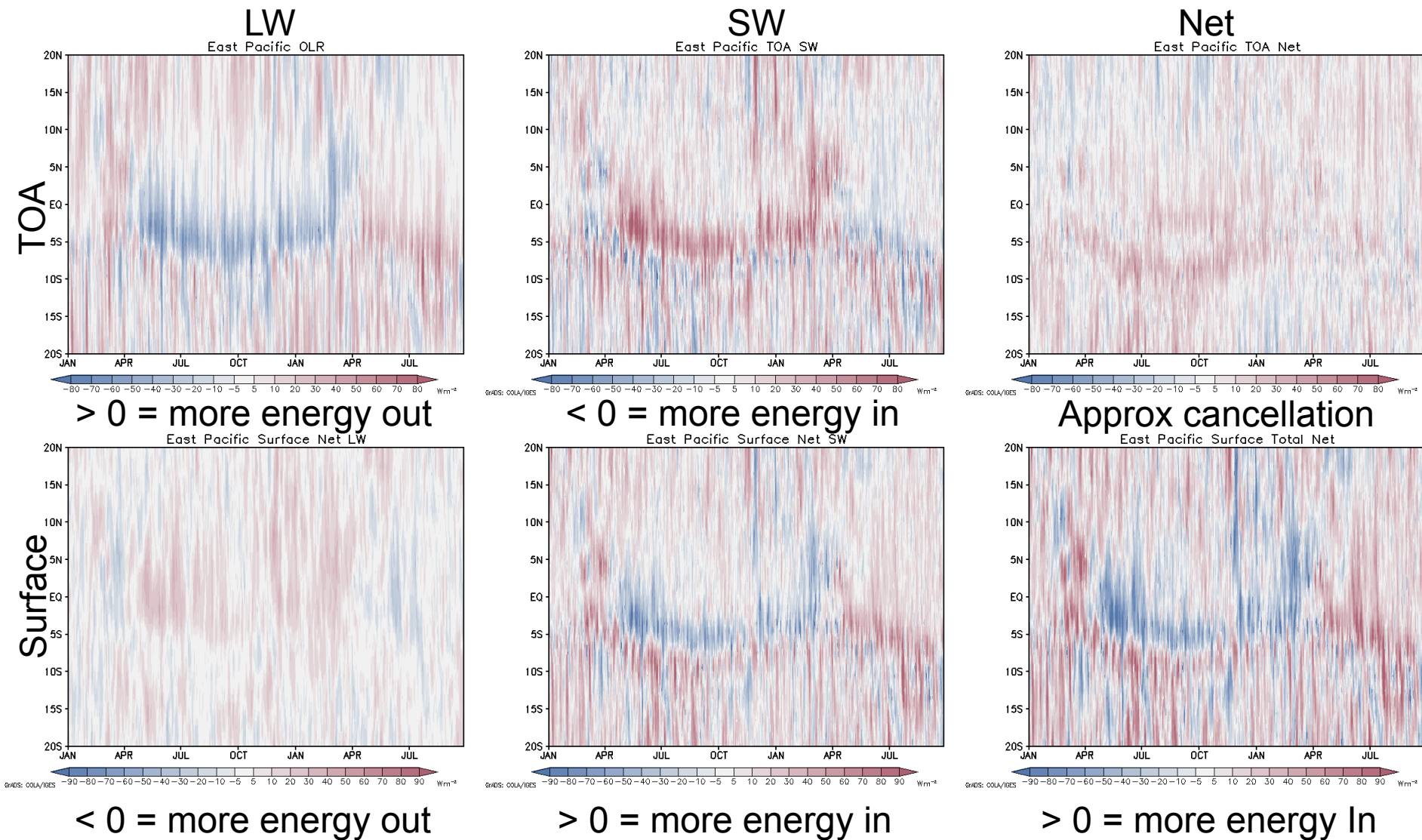


Central Pacific Daily 2015/16 Minus 2013/14



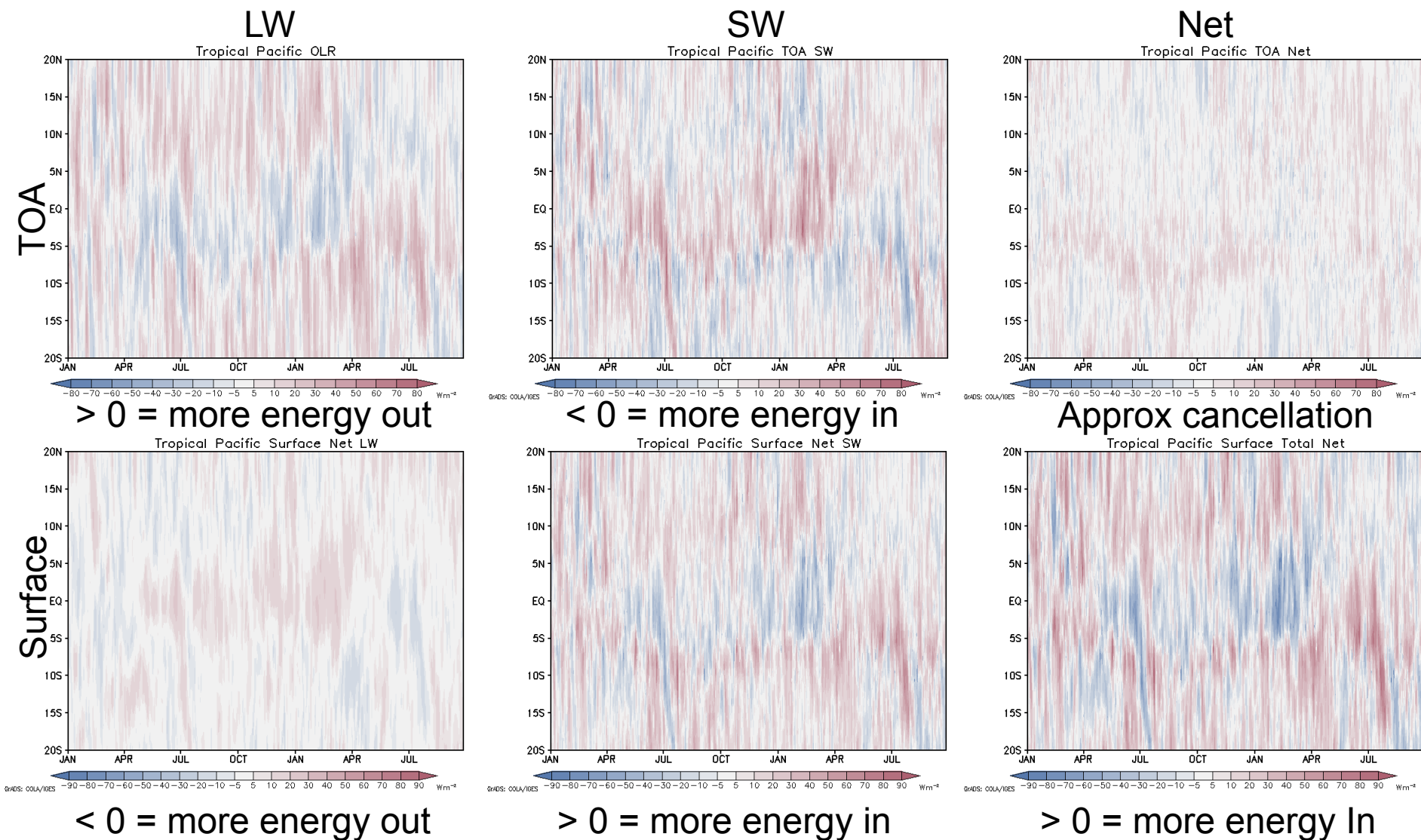


Eastern Pacific 2015/16 Minus 2013/14





Tropical Pacific Daily 2015/16 Minus 2013/14



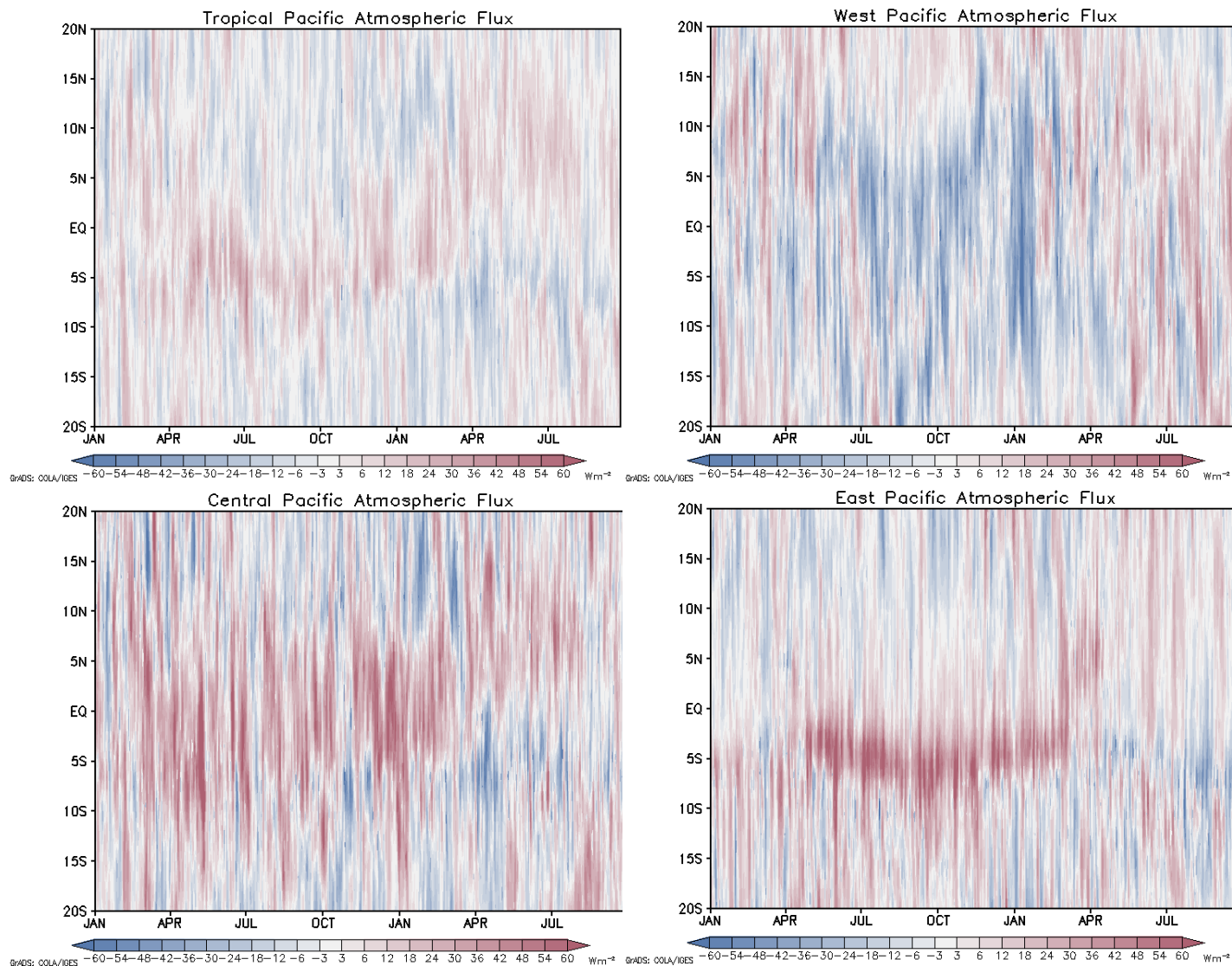


Atmospheric Flux Divergence

Atmos. Flux
Divergence =
Net TOA –
Net Surf

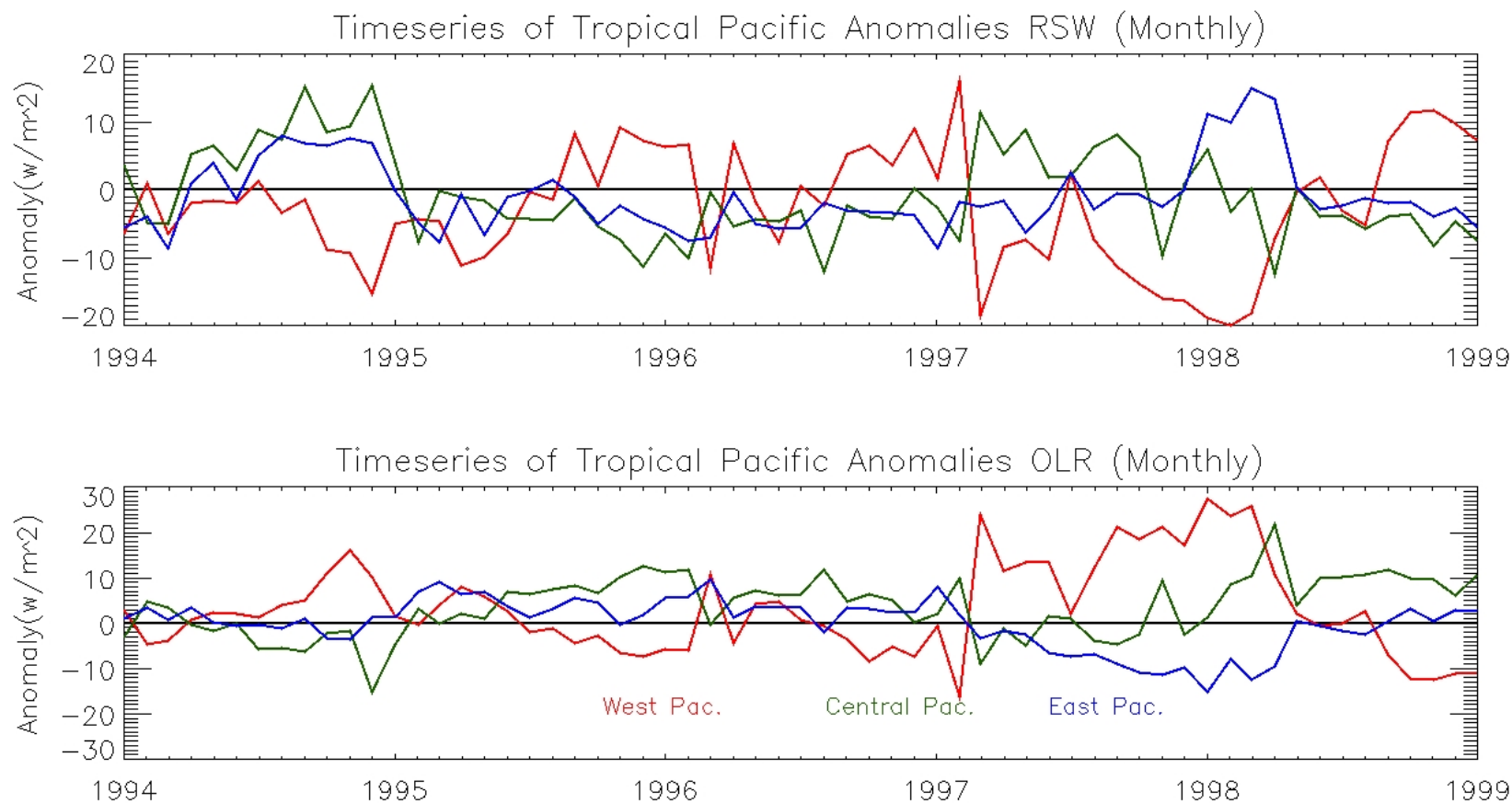
< 0 increase
in net cooling
of the
atmospheric
column

> 0 decrease
in net cooling
of the
atmospheric
column





1998/99 El Niño: TOA Flux Anomalies [SRB]



The **West** Pacific and **East** Pacific region follow a similar pattern to 2015/16 El Niño, while the **Central** Pacific remains mostly neutral.



Summary and Conclusions

- ***2015-2016 El Nino rivals 1998-1999 El Nino***
 - Large perturbations in indexes found
 - 2015/2016 a Eastern Pacific El Nino by SST, but radiative anomalies in both Eastern & Central Pacific region; the latter seem to dominate the region
 - 1998/1999 a Eastern Pacific El Nino with radiative anomaly changes also in Eastern before migrating westward
- ***2015-2013 Large Spatial differences***
 - Greater 2 sigma change on global basis for RSW
 - SST changes result $> 10 \text{ W m}^{-2}$ perturbations Pacific & Up/Down US
- ***Anomaly Analysis by Tropical Pacific Regions***
 - Both Central and East Pacific compensate for Western Pacific and have about $\frac{1}{2}$ the anomalies of the western region; E& C span entire time
 - Overall Net from positive in 2015 to negative in 2016
- ***Time/Lat of Daily 2015/16 Minus 2013/2014***
 - Shows that convective cloud in central Pacific tends to dominate and shifts from about 10S to the 10N
 - Atmospheric divergence increases in dominant convective region, but decrease to north and south



FLASHFlux Web Sites:

<http://flashflux.larc.nasa.gov>



Extras



El Nino Index

